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Introduction to International Livestock Research Institute's agenda for climate change adaptation in livestock systems

Todd A Crane and Kristin Girvetz

Background

Livestock keepers and the stakeholders who support them through research, policymaking, and program implementation need more support to adapt livestock systems to the growing challenges of climate change. In sub-Saharan Africa alone, there are over 300 million impoverished people who rely on livestock as a key primary or even sole productive asset (Herrero et al. 2014). For many of these people, livestock also serve as their financial backup in times of economic stress. Similarly, Asia is home to over half of the world's total livestock population, including pigs, chickens and ruminants. Of these, 50–70% are kept by smallholder producers (Ahuja 2013). In recent decades, the number of livestock in Africa and Asia have maintained growth trends in response to increasing consumer demand and rural livelihood needs, trends which are expected to continue into the foreseeable future. Livestock systems in both regions are characterized by significant vulnerabilities to climate change impacts.

Climate change impacts are affecting livestock systems through a variety of pathways. Dryland pastoral systems often receive the most attention in climate change interventions due to periodic droughts. However, dryland pastoralists are also perhaps the most attuned to drought management strategies, as they emerged from the need for resilience in the face of high environmental variability. Despite this common association, climate change adaptation is actually an issue in all kinds of livestock systems, from extensive dryland pastoral systems to mixed crop-livestock systems and intensive dairy systems. Heat and water stress, fodder productivity, as well as parasite and disease pressures are being affected by climate change in different ways and in different production systems (Thornton and Herrero 2009). Furthermore, as climate change impacts may reduce crop yields and profitability in mixed systems, livestock may become increasingly important elements of smallholder livelihoods in many places.

Compared to cropping systems, livestock systems still remain under studied and under represented in the science and policy discussions of adaptation. Substantial knowledge gaps in livestock adaptation strategies make

it difficult to effectively develop and target adaptation interventions that support livestock keepers. Despite adaptation in livestock systems being a high priority in developing countries, the international community—including CGIAR's research program on Climate Change, Agriculture and Food Security (CCAFS)—has been investing much more on lowering GHG emissions intensities from livestock systems than supporting the priorities of nations to adapt livestock systems to current and future climate stresses. While there is likely some overlap in practices that support both adaptation and mitigation, the general lack of knowledge production and practical interventions regarding adaptation in livestock systems makes it difficult to confidently target and leverage potential synergies.

Substantial investment in research and interventions in support of adaptation in livestock systems can contribute to important outcomes in livelihoods, nutritional security and environment. In addition to being sources of food and other products, livestock often also serve as salable assets to cope with financial stresses. Because so many people in vulnerable regions depend on livestock as key sources of food and income, measures must be taken to adapt to climate change in order to protect their livelihoods. In addition to sustaining rural livelihoods, pursuing climate change adaptation in livestock systems can also contribute to nutritional security at both household and national levels through maintaining or improving access to nutrionally dense foods. Animal source foods hold an important place in food systems as sources of high-density protein and micronutrients. Without adaptation measures, climate change impacts on livestock systems threatens to degrade nutritional security of both the rural and urban poor. Finally, climate change adaptation measures can contribute to improving environmental outcomes. Many likely adaptation measures are based on closer attention to natural resource management, such as with land, water and organic matter. This means that well-considered adaptation interventions will improve environmental stability and resilience.

The purpose of this collection is to outline ILRI's agenda for implementing practical interventions and conducting basic research for climate change adaptation in livestock systems in developing countries. Scientists from across ILRI's programs have contributed to five thematic concept notes which have been designed to capture key subjects for both basic research and impact oriented outreach:

1. Rangelands
2. Feeds and forages
3. Animal health
4. Animal breeding and genetics
5. Policy and decision support

ILRI's objectives

ILRI's work within the five thematic areas will contribute to three primary objectives:

1. **Develop, test and deploy adaptation practices and technologies at scale.** Different livestock production systems have different adaptation needs, which may be met by variable combinations of broad technical domains: feeds and fodders, animal and human health, animal breeding and genetics, and rangeland management. This product line blends upstream basic research with outreach efforts for achieving impact at scale.

2. **Support the planning, design and implementation of adaptation policies and investment by governments, donors and development NGOs.** We will achieve this by generating a better understanding of climate change impacts on livestock systems and identification of impact hot-spots. This will be done by continuously updating and downscaling climate change projections and incoming evidence from adaptation tracking. Furthermore, ILRI will contribute to strengthen the capacity of policy makers through the development of a decision making framework that can identify and target best-bet adaptation strategies for various livestock systems. This framework will combine an inventory of practices, the biophysical and social conditions for their effectiveness, and trade-off analyses to identify potential downsides to particular adaptation practices.

3. **Track the social and environmental impacts of climate change and adaptation strategies for livestock producers.** Monitoring, reporting and verification protocols for GHG emissions are well developed, but frameworks and methods for tracking social and environmental aspects of adaptive capacity are only now just beginning to be developed. Such frameworks and methods will be necessary as countries start to report against international agreements and obligations.

Rather than being discrete silos, these three product lines overlap and intertwine, as do the thematic subjects. For example, research on developing and testing adaptation practices needs to be embedded within efforts to promote and disseminate the practices. This process may involve private sector partners or development NGOs and may, furthermore, involve engagement with policy makers to create an enabling policy environment. Likewise, improving dairy breeds needs to go hand in hand with improving quality and quanity of fodder which may involve basic research on fodder production combined with facilitation of improvements in the seed and fodder value chains. Overall, ILRI's combination of basic research and applied engagement, as well as our integration of biophysical and social science knowledge products, gives us a very strong position to be a pivotal actor in promoting climate change adaptation in livestock systems.

ILRI's outcomes

By implementing against these three objectives, ILRI will achieve the following:

1. **Livestock producers will have improved access to high quality knowledge and technologies that will assist in adapting to climate change in their livelihoods.** This will lead to higher productivity and greater household resilience in the face of climatically induced stresses, such as drought. This in turn will promote greater national and regional food and nutritional security. It is important to note that many adaptation technologies will be based on improving production efficiencies and environmental health, both factors associated with reducing GHG emission intensities in livestock systems, thus complementing ILRI's existing and expanding agenda on climate change mitigation in livestock systems.

2. **Policy makers, donors and international NGOs will be able to better target and tailor their interventions and programs to support adaptation in livestock systems.** The high quality findings, refined models and improved technologies that will emerge from ILRI's upstream research will inform more effective planning, prioritization and implementation of appropriate and effective adaptation measures.

3. **Beyond improving livelihoods and food security in the face of climate change, ILRI will contribute to increasing national capacities to report against targets that are set in international agreements.** For example, Nationally Determined Contributions (NDCs) specify both adaptation and mitigation targets and the United Nations Framework Convention on Climate Change (UNFCCC) should soon provide a framework for reporting on adaptation in agricultural sectors. ILRI's work will help make this framework operational through methodological developments that are tailored to livestock systems and building capacity of national governments for implementation of adaptation tracking.

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ILRI's impact and capacity

ILRI can drive impact for livestock keepers through an integrated approach to climate change adaptation in livestock systems. ILRI's combination of basic upstream research and downstream outreach through partners, as well as biophysical and social sciences, make it uniquely suited to take an integrated approach to climate change adaptation in livestock systems. Climate change adaptation in livestock systems is urgent. Even though we need more information, we also need to act now while simultaneously pursuing a robust long-term research agenda. Such an approach promises to provide continuous feedback loops between adaptation interventions and basic livestock research agendas. Climate change adaptation involves new technologies and practices, but those are inevitably implemented by livestock keepers in a social setting. Changing technologies and practices is affected by social dynamic, such as intrahousehold gender relations, community socio-economic differences and landscape governance to name a few. Combining technical research and social research enables a holistic approach to understand adaptation challenges and facilitate adaptation solutions in livestock systems.

ILRI's proposed work on adaptation is aligned with CGIAR priorities and will fill gaps in their implementation. Climate change is a cross-cutting theme in the CGIAR Strategic Results Framework, and our proposed work links directly with several sub-Intermediate Development Objectives (sub-IDOs), including increased household capacity to cope with shocks, reduced pre- and post-harvest losses including those caused by climate change, increased availability of diverse nutrient-rich foods, reduced livestock and fish disease risk associated with intensification and climate change, minimized and reversed land water and forest degradation, increased resilience of agroecosystems and communities, and enhanced adpative capacity to climate risks. Furthermore, ILRI's approach to climate change adaptation in livestock systems aligns with key objectives in the CGIAR Research Programs (CRPs) on Livestock Agrifood Systems, Climate Change, Agriculture and Food Security (CCAFS) and Agriculture for Nutrition and Health (A4NH). Our close alignment with CGIAR Strategic Results Frameworks and CRPs means the foundations—conceptual, technical and staffing—for the work outlined here are largely in place. CCAFS' funding has thus far focused on low-emission development in livestock systems over adaptation, while Livestock and A4NH are only just beginning to consider climate change adaptation issues. We see this as an opportunity to mainstream climate change adaptation in livestock systems into these programs.

ILRI, already a leader in research for development in livestock systems, is poised to be a leader on climate change adaptation in livestock systems within the CGIAR and globally. In recent years, ILRI has successfully implemented a variety of projects related to climate change adaptation in livestock systems. This work includes research on rangeland ecology, as well as rangeland governance, in both East and West Africa. These have been oriented on increasing productivity, developing livelihoods and promoting environmental stability in the face of droughts by improving value chains, rangeland management and strengthening institutional capacities. In addition to research, ILRI has also been engaging in practical work on rural development planning with sub-national governments in both Kenya and Ethiopia, helping to overcome disconnects between humanitarian and development interventions in dryland pastoral systems. Also in rangelands, ILRI's Index Based Livestock Insurance (IBLI) is a cutting edge program that has brought insurance to over 25,000 livestock keepers in northern Kenya and southern Ethiopia, insuring a total value of over USD40 million in livestock. In developing the financial instrument of insurance for remote dryland pastoralists, IBLI has collaborated with private sector insurance companies as well as the Kenyan government to reduce risk of catastrophic losses during droughts. The Local Governance and Adaptation to Climate Change project, funded by USAID, examined the ways in which local institutional dynamics influenced adaptation pathways and the social distribution of adaptation practices of livestock keepers. Publications from this project will start to come

out in 2019 covering governance institutions, technology adoption and gender and ethnic norms. At the end of 2018, ILRI began implementing a 4-year project with total funding of USD6.5 million. The GIZ-funded Project for Climate Smart Livestock (PCSL) that integrates research and capacity building on both adaptation and mitigation in Kenya, Ethiopia and Uganda will conduct cutting edge basic research while also enhancing the capacity of stakeholders to plan and engage in climate change adaptation and mitigation through deliberate and iterative engagement with policymakers as well as participatory action research with livestock keepers.

ILRI's strategic partnerships provide the platform for impact and scale. Our direct engagements with government ministries, development organizations and research universities are important elements of ILRI's ability to achieve impact at scale. For example, ILRI has worked closely with the Kenyan State Department of Livestock in the Ministry of Agriculture, Livestock and Fisheries to develop a research agenda that aligns with Kenya's emerging low emission livestock development. ILRI has also worked closely with government ministries to develop livestock master plans in Ethiopia and Tanzania. By engaging in policy making processes as a part of our research approach, ILRI is able to achieve high-level impact. ILRI's collaborations with development organizations such as Heifer International, Oxfam International, Alliance for a Green Revolution in Africa, Overseas Development Institute, Terra Nuova and SNV enable more effective impact on livestock keepers' practices and livelihoods through strategic partnership. Finally, ILRI's internal research quality is further enhanced by regular partnerships with global leading research universities such as Cornell University, Wageningen University and Research Centre, Emory University, Swedish University of Agricultural Sciences, University of California-Davis, Karlsruhe Institute of Technology, Colorado State University, Norwegian University of Life Sciences and many others.

ILRI's existing facilities are well suited to support basic research, practical implementation and capacity building relating to climate change adaptation. ILRI currently has substantial scientific infrastructure in place that can support much of the adaptation research proposed here. Kapiti Ranch, 90 minutes southeast of Nairobi, is a 32,000 acre field research station that is an invaluable site for large-scale experiments and trials in semi-arid rangelands.

ILRI's Mazingira Centre is an environmental research laboratory that focuses on the environmental footprints of livestock, with an emphasis on soils, nutrient cycle and greenhouse gas emissions. It is the only lab of its kind in sub-Saharan Africa. ILRI is also home to a feeds and forages genebank with more than 19,000 accessions from over 1000 species. Finally, ILRI is home to the Biosciences East and Central Africa (BecA) Hub, a laboratory facility which focuses on training early and mid-career African scientists in cutting edge bioscience research techniques. Between 2014 and 2018, BecA and ILRI's other science units have trained 55 African PhD students, 89 African MSc students and 201 other research fellows, contributing to the enhancement of needed scientific capacity in Africa. Looking beyond ILRI's research units, the Impact at Scale unit is focused on implementation of extension and outreach efforts in order to scale out technologies and practices developed by ILRI research units.

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Contact

Todd A Crane
Senior scientist - Climate change adaptation
Nairobi, Kenya
t.crane@cgiar.org

ILRI thanks all donors that globally support its work through their contributions to the CGIAR Trust Fund

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa

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